Here, the internationally highly regarded and fruitful collaboration between the Max Planck Society, DESY and the University of Hamburg is intensified even further.

The MPSD currently has around 150 employees and consists of three scientific departments focusing on solid state physics, physical chemistry and theoretical methods in these fields. A new expansion building being constructed next door to the growing institute is due for completion in 2020 and will house two new departments. The building will contain vibration-free laser laboratories as well as laboratories for sample preparation and a large data center to provide high-performance computing platforms.

The Max Planck Society

The MPSD is one of currently 84 institutes under the umbrella of the Max Planck Society (MPS), a charitable and independent research organization. It is funded at national and federal state level and pursues fundamental research for the public good in the natural and social sciences as well as the humanities.

Directors

Prof. Dr. Andrea Cavalleri
Prof. Dr. R. J. Dwayne Miller
Prof. Dr. Angel Rubio

Max Planck Institute for
the Structure and Dynamics of Matter,
Center for Free-Electron Laser Science
Luruper Chaussee 149, Building 99
22761 Hamburg, Germany

Contact

Telephone: +49 (0)40 8998-6570
Fax: +49 (0)40 8994-6570
Internet: www.mpsd.mpg.de
E-Mail: info@mpsd.mpg.de

Imprint:

Responsible person in editorial matters: Prof. Dr. Angel Rubio
Editorial and design: Jenny Witt, Dr. Jörg M. Harms
Photos/graphics: Dr. J. M. Harms, hammeskrause Architekten

mpsd

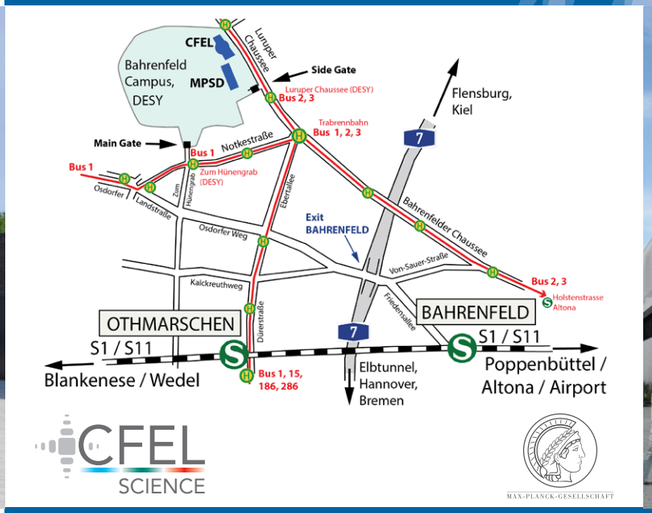
Max Planck Institute for the Structure and Dynamics of Matter

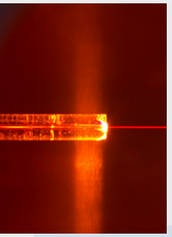
The Institute

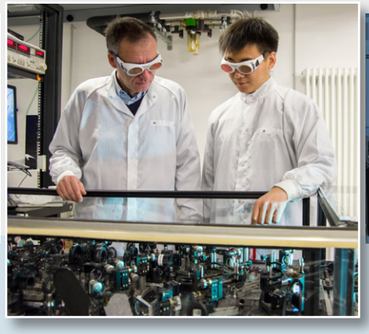
At the MPSD, scientists use ultra-short light flashes to study the structure as well as the atomic and electron movements of matter. These dynamic phenomena are probed with light pulses in the femto- and attosecond range – in other words, in a billionth of a millionth of a second.

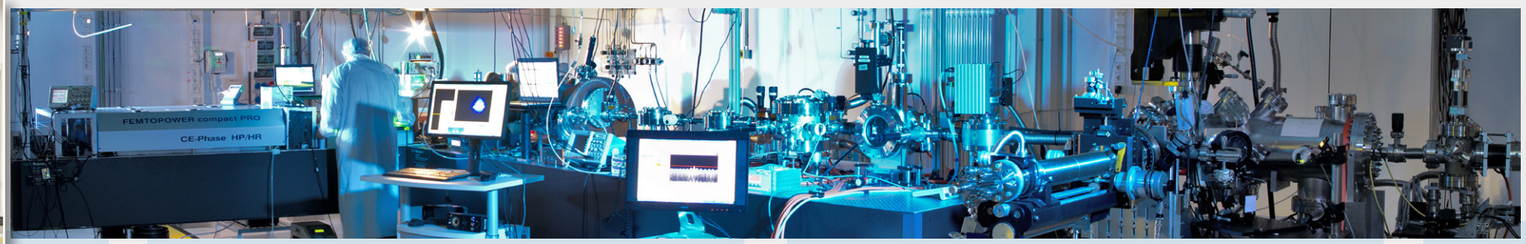
Such time-resolved observations provide completly new insights into the properties of a wide variety of materials and their potential use. To this end, Hamburg offers a unique range of powerful light sources on the research campus Bahrenfeld, from the Free-Electron Laser FLASH and the European XFEL to the PETRA III synchrotron radiation source.

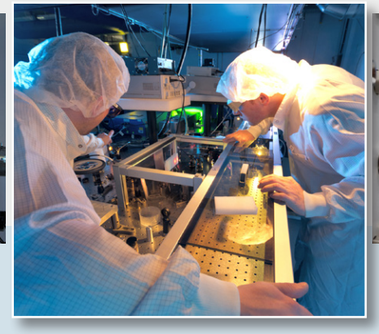
The MPSD, which was founded in 2012, shares the Center for Free-Electron Laser Science (CFEL) on the Bahrenfeld campus with the Deutsches Elektronen-Synchrotron (DESY) and the University of Hamburg.











Condensed Matter Dynamics Department

The department under director Andrea Cavalleri combines laser spectroscopy with X-ray experiments to investigate the structural dynamics of complex solid state matter.

Here, scientists study how the electrical, magnetic and structural properties of solid materials change when they are excited by light. Superconductors, which carry electricity without any resistance, are a particular research focus.

Phase transitions, such as when a material changes from an insulator to a metallic conductor or even a superconductor, are of great interest. The materials are excited, manipulated and examined with ultra-short, synchronized light flashes.

Scientists utilize table-top lasers in individual laboratories as well as large accelerator light sources such as LCLS in Stanford, California, or the European XFEL in order to advance research in this area.

Atomically Resolved Dynamics Department

Can we observe chemical reactions in slow motion?

The department of director R. J. Dwayne Miller explores fundamental questions about the relation between the function and structure of molecular matter.

Femtosecond electron diffraction and multi-dimensional coherent spectroscopy are used as experimental methods in liquids as well as in biological and molecular systems. Advanced intensive electron sources observe atomically resolved dynamics in real time and thus generate “atomic movies” of chemical and biological processes.

This department develops and runs several beam lines for ultra-short electron diffraction. It advances sophisticated techniques for the electron microscopy and mass spectroscopy of proteins on the basis of fundamental physical and chemical structural dynamics experiments. The medical application of non-destructive short pulse lasers is a further focus of its work.

Theory Department

Can light interact with matter in such a way that it produces new materials with specially tailored properties? The department of director Angel Rubio investigates the electronic and structural properties of advanced materials, nanostructures and biomolecules. It develops new theoretical methods and computational codes to examine and control the electronic response of such systems in time-dependent electromagnetic (quantum) fields.

The department aims to provide a detailed, efficient, and accurate microscopic approach for the ab-initio description and control of the dynamics of decoherence and dissipation in quantum many-body systems. The search for and characterization of new non-equilibrium states of matter is a further research focus.

An Emmy Noether Group, one of the independent junior groups at the MPSD, is located in the theory department. It works on the theory of pump-probe spectroscopy in solid state systems.

Junior Groups

The junior research groups, led by promising scientists at the institute, work independently on their own research projects.

Scientific Service Units (SSUs)

The SSUs support scientists from all groups in the design, construction and operation of individually produced experimental set-ups. There are currently two SSUs at the institute, working in the areas of machine physics and ultra-fast electronics.

IMPRS-UFAST Graduate School

The institute has a structured graduate study course with a strong international focus: the International Max Planck Research School for Ultrafast Imaging & Structural Dynamics. Its members are supervised jointly by scientists from the MPSD, DESY, the University of Hamburg and the European XFEL.